

Chapter 10

Conclusions

Fermilab E769 is the first experiment in which charm production induced by π , K , and p beams is studied at a common beam energy and using a single target and spectrometer. E769 data, obtained using negatively and positively-charged mixed hadron beams, provides unique information on the beam dependence of charm production. In addition to significant high-statistics contributions to current knowledge on π^- and p -induced production, E769 has published the first precise K^- beam measurements as well as the only measurements for π^+ and K^+ . Moreover, few published charm cross-section measurements benefit from full mass reconstruction and identification and momentum determination of secondary particles. In this category, our data set represents a factor-of-two improvement in the number of π -induced charm decays; for K and p beams, ten and three-fold increases in statistics, respectively, are realized [17, 19, 2, 12].

In this thesis, we have presented measurements of forward production cross-sections for a number of charm mesons. Taken together, cross-sections of the pseudoscalar mesons and baryon¹ studied in E769 analyses are expected to constitute the bulk of the total charm cross-section. E769 results, together with previous data, are consistent with the energy dependence predicted by perturbative QCD. The sums of our measured cross-sections suggest a total charm cross-section which is higher than but consistent with theory. In addition to these absolute cross-section results, we

¹See [10] for E769's Λ_c cross-section results.

have measured differential cross-sections $d\sigma/dx_F$ and $d\sigma/dp_T^2$ for D meson production with sufficient sensitivity to observe their dependence on the gluon distributions of the projectile particles, thereby providing new evidence of the relative hardness of the gluons in pions and kaons compared to those in protons. This agreement between experiment and theory reinforces the applicability of a perturbative framework for high-energy production of charm.

Appendix A

Glossary of Acronyms

DC	drift chamber
DISC	differential isochronous self-collimating Čerenkov counter
HMRSB	proton PDF of Harriman <i>et al.</i> [28]
LO	leading order
MC	Monte Carlo
NLO	next-to-leading order
FMNR	theorists Frixione, Mangano, Nason, and Ridolfi [26]
MNR	theorists Mangano, Nason, and Ridolfi [32]
NDE	theorists Nason, Dawson, and Ellis [36, 37]
PMT	photomultiplier tube
PDF	parton distribution function
PDG	particle data group [34, 35]
QCD	Quantum Chromodynamics
SMD	silicon microstrip detector
SMRS2	pion PDF of Sutton <i>et al.</i> [28]
TPL	Tagged Photon Lab
TRD	transition radiation detector

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